

Notes

An Aberration of *Glaucopsyche lygdamus* (Lycaenidae) with a Complete Scolitantidine Dorsal Pattern

On 8 April 1982 I took a female *Glaucopsyche lygdamus incognitus* Tilden at Rancho Cordova, Sacramento Co., California, displaying an extensive dorsal pattern of black spotting on a blue ground, reminiscent of the normal pattern of several Palearctic genera such as *Maculinea*. Females of this population are normally black with more or less blue basally, and the aberration (Fig. 1) is much more extensively blue than is commonly seen. Ventrally, the postmedian spot-band is enlarged and slightly distorted and the ground-color somewhat darker than average. No abnormalities were observed in a sample of about 20 animals examined and released at the site.

The resemblance to *Maculinea* and other Scolitantidines is extremely suggestive of homology. Mattoni (1981, The Scolitantidini. II. The world's smallest butterfly? Notes on *Turanana*, and a new genus and species from Afghanistan (Lycaenidae). J. Res. Lepid. 18:256-264) gives the occurrence of the dorsal pattern in several taxa of the genera *Micropsyche*, *Turanana*, and *Glaucopsyche*. According to Mattoni (*in litt.*) it occurs in some *Turanana*, *Micropsyche*, *Phengaris*, *Shijimiaoides*, and *Philotes* (*sonorensis*); in *Shijimiaoides* it is limited to females, as in *Maculinea alcon*. The genus *Caerulea*, which seems more closely related to *Glaucopsyche* than is *Maculinea* according to Mattoni, lacks the pattern (but cf. Higgins, 1975, *The Classification of European Butterflies*. Collins, London. 320 pp. [pp. 131-133]). Whatever the proper relationships within this group, the genetic control of the pattern is apparently labile, with more than one reversal or parallelism necessary in their history.

A similar aberration in female *Glaucopsyche melanops* has been reported by Chapman (1905, Trans. Ent. Soc. Lond. 53:ii-iii), who also noted the similarity to *Maculinea*. *G. melanops* is quite a distinct species of *Glaucopsyche*, and morphologically stands apart from the other six or so species in that genus. Chapman named the aberration var. "wheeleri," on the basis of two specimens from Digne.

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A Reared Gynandromorph of *Tatochila* (Pieridae)

On 2 April 1981 a mosaic gynandromorph emerged in a laboratory culture of the *Tatochila sterodice* Stgr. species-group, derived from Argentina (Pieridae). The specimen (Fig. 2) is an F₁ hybrid of *T. s. sterodice* male, ex San Martin de los Andes, Province of Neuquen, and *T. vanvolxemii* Capr. female, ex Bahia Blanca, province of Buenos Aires. It was reared without diapause under 10 hours light, 14 dark, day and night temperatures 75°F=23.9°C and 55°F=12.8°C respectively.

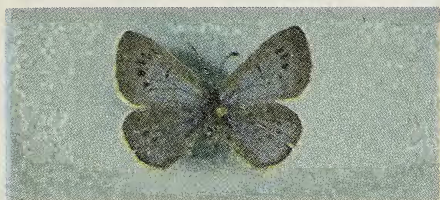


Fig. 1. Aberration of *Glaucopsyche lygdamus*.



Fig. 2. Reared gynandromorph of *Tatochila sterodice* x *van-volxemii* hybrid, upper and under surface. See text.

NOTE: Fig. 2 (only) is reversed due to a printing error.

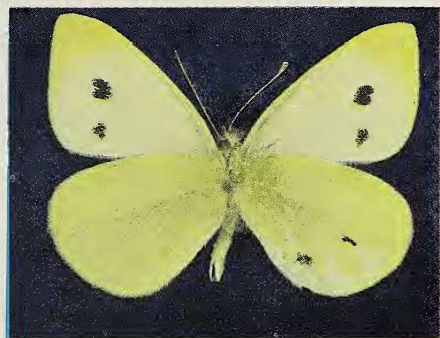


Fig. 3. Reared homoeotic male *Pieris rapae*, stock ex Xochimilco, Mexico. Note FW tissue on one ventral HW (see text).

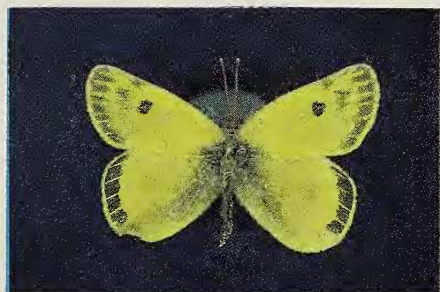


Fig. 4. Wild "intersexual" *Colias eurytheme*, upper and under surfaces; note "feminization" of dorsal FW pattern.

The body and three wings are completely male. The left forewing is mosaic above and entirely male below. Its upper surface is about 85% female; the male area occupies the costal margin down to vein M_1 , with a mixture of male and female scales in interspace M_1 - M_2 marginad of the dark submarginal band. The outer margin is slightly convex on the mosaic wing, a female character. The shape of the submarginal band on the female surface is slightly abnormal.

This is the only sexual mosaic produced in a complex hybrid culture of some 7000 butterflies reared over 18 months. Another F_1 brood produced a bilateral male-male mosaic, presumably resulting from a doubly-fertilized binucleate egg (Shapiro, 1982, Experimental studies of the evolution of seasonal polyphenism. In R. Vane-Wright and P. Ackery, eds., *The Biology of Butterflies*, Symp. Royal Ent. Soc. of London, in press).

Sibatani's (1980, Wing homoeosis in Lepidoptera: a survey. *Devel. Biol.* 79:1-18) analysis of 44 published gynandromorphs shows that sexual mosaicism is commoner on the fore- than the hindwings and on the dorsal than the ventral surface; there is no right-left difference. Of 19 Pierid gynandromorphs, 13 were confined to the dorsal surface, 1 to the ventral, 5 mixed. Thus, this individual is of the statistically commonest type of mosaic gynandromorph. It is very close to a $\frac{3}{4}$ male- $\frac{1}{4}$ female individual, but the presence of male tissue on the aberrant wing suggests the chromosome accident occurred early in the history of the wing primordium but subsequent to the second zygotic division, which would give a neat $\frac{1}{4}$ picture.

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Two Homoeotic *Pieris rapae* of Mexican Origin (Pieridae)

"Homeosis" was defined by Pennak (1964, *Collegiate Dictionary of Zoology*. Ronald Press, New York. 583 pp.) as "transformation of one organ into another by mutation... occurrence of an homologous appendage on a segment where it does not normally occur." In Lepidoptera, transformations of entire organs are virtually unknown, and the term, now usually spelled "homoeosis," refers to the patchy conversion of areas on the wings into areas appropriately placed on a different wing or on the other wing surface. Recognition of this condition depends on pattern differences which render the inappropriately-placed areas conspicuous. It seems to be very rare; most recognized examples have probably been published, and a majority figured. Sibatani (1980, Wing homoeosis in Lepidoptera: a survey. *Devel. Biol.* 79:1-18) reviewed 164 cases and presented statistics on the topology of the transformations.

A homoeotic male *Pieris rapae* L. (Pieridae) eclosed 19 June 1982 in the first generation of a laboratory stock established 5 March 1982 from several females collected at Xochimilco, Distrito Federal, Mexico, the southernmost known population of *P. rapae* in the Americas, for photoperiodism studies. The aberration was reared under 10L:14D with day and night temperatures of $70^\circ\text{F}=21.1^\circ\text{C}$ and $40^\circ\text{F}=4.4^\circ\text{C}$, and did not diapause. It is shown in Fig. 3. It is similar to a homoeotic male *P. brassicae* L. figured by Gardiner (1963, Genetic and environmental variation in *Pieris brassicae*. *J. Res. Lepid.* 2:127-136 [p. 134]) in having part of one ventral hindwing converted into ventral forewing. Because of the rearing regime, the

ventral ground color is bright yellow and the white converted area is easy to delimit. It contains both of the black ventral forewing discal spots in their proper interspaces. The entire homoeotic area is posterior to Sibatani's M₁-M₂ barrier. All other wings and surfaces are apparently normal.

On 17 August 1982 a homoeotic female emerged in the same culture. This individual, shown alive in Fig. 5 (black and white) as it was to be bred, was reared under 10L:14D with day and night temperatures of 75°F=23.9°C and 55°F=12.8°C, and diapaused. It was from the same generation as the first; as noted, the culture was started by pooling the ova of several wild females, but it seems very likely that the two homoeotic individuals are full sibs. The converted area is nearly identical to that on the male, and like it the abnormality is confined to the ventral left hindwing. To date (early September 1982) no further aberrations have appeared in a total of some 570 animals examined from this culture, reared on several regimes.

Gardiner (*loc. cit.*) reported a cluster of three homoeotics deriving from a single mating involving hybridization of typical *brassicae* with subspecies *cheiranthi* Hbn. from the Canary Islands. All were males. One was sib mated and the line inbred for three generations, but no additional homoeotics appeared in a total of some 900 progeny. As our Mexican *rapae* line is to be continued for some time and diapausing members of the first generation are still in cold storage, every effort will be made to investigate the presumptive genetic predisposition to homoeosis. The extraordinary

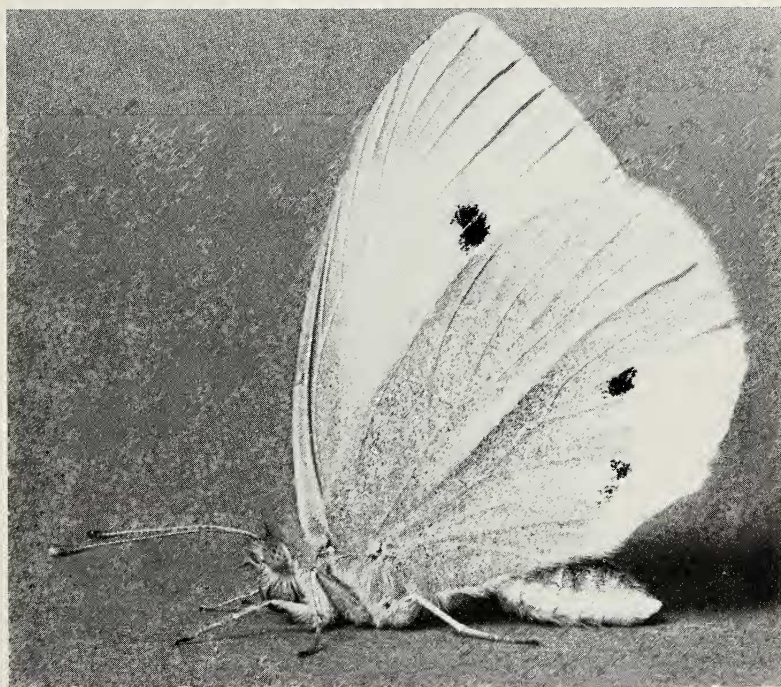


Fig. 5. Reared homoeotic female *P. rapae* from Xochimilco, photographed alive by S. W. Woo.

rarity of two homoeotics appearing in the same brood is underscored by their being the first and second homoeotic butterflies I have observed in over 20 years of collecting and breeding, including the rearing of perhaps a quarter of a million Pieridae for physiological and ecological studies.

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An Apparent "Intersexual" *Colias eurytheme* (Pieridae)

In most Nearctic *Colias* species, the female forewing has a broad dark marginal band enclosing spots of the ground-color while the band on the male is continuous, narrow, and interrupted only by ground-color along the veins, if at all. This difference does not hold in some Palearctic species, in the circumpolar *C. nastes* Bdv., and in some South American species.

A *C. eurytheme* Bdv. showing a partial "feminization" of a male pattern was taken 18 February 1982 at Rancho Cordova, Sacramento Co., California. The specimen (Fig. 4) is genitically male. The dorsal forewings have a double dark band enclosing the light ground color, in this regard resembling late winter-early spring females. Ventrally there are non-sexual anomalies: the forewing discal spots are divided or doubled like those on the hindwing, and there is a rudimentary accessory discal spot basad of the actual, doubled one on the right hindwing. The shape of the forewings is abnormal, and the flight of the animal was very low and direct, just above the ground.

Well-developed male examples of the winter-spring form "ariadne" of *C. eurytheme* occasionally show a very slight development of the inner dark band just below the dorsal forewing apex, enclosing one small "spot" of ground-color anterior to $R_3 + 4$. The Rancho Cordova specimen seems to represent an extreme manifestation of this tendency in which the developmental control mechanism which normally inhibits the inner band in males failed to do so. This may or may not be attributable to abnormalities in the sex-determination mechanism. Although the relationship between the male and female patterns in *Colias* could be interpreted in two ways, the general rule that reduction is "easier" than complexification in evolution suggests that the normal *eurytheme* male pattern is a reduction from the female, and thus evolutionarily derivative. The present aberration would then be considered reversional, or atavistic. If the Andean *Colias* (*Colias*) are monophyletic, either at least one reversal or one convergence or parallelism for this character has occurred, since the species *flaveola* Butl. and *weberbaueri* Stgr. are monomorphic or nearly so, the others sexually dimorphic for the forewing border.

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